FORM PTO-1390 (Modified) (REV 11-98) U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371

ATTORNEY'S DOCKET NUMBER	U.S. APPLICATION NO. (IF KNOWN, SEE 37 CFR)
60132-074	09/674585

INTERNATIONAL APPLICATION NO	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/US99/16412	20 July 1999 (20.07.99)	23 July 1998 (23.07.98)

TITLE OF INVENTION
ELECTRO-OPTICAL MECHANICAL INSTRUMENT

APPLICANT(S) FOR DO/EO/US
DEWEERD, Herman; BEACH, Michael and HERNANDEZ, Jose

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This is an express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date
5. ☒ A copy of the International Application as filed (35 U S.C. 371 (c) (2))
   a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ has been transmitted by the International Bureau.
   c. ☒ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ A copy of the International Search Report (PCT/ISA/210).
8. ☐ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371 (c)(3))
   a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
   d. ☒ have not been made and will not be made.
9. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
10. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371 (c)(4)).
11. ☒ A copy of the International Preliminary Examination Report (PCT/IPEA/409).
12. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371 (c)(5)).

Items 13 to 20 below concern document(s) or information included:

13. ☐ An Information Disclosure Statement under 37 CFR 1 97 and 1.98.
14. ☐ An assignment document for recording A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
15. ☐ A **FIRST** preliminary amendment.
16. ☐ A **SECOND** or **SUBSEQUENT** preliminary amendment.
17. ☐ A substitute specification.
18. ☐ A change of power of attorney and/or address letter.
19. ☒ Certificate of Mailing by Express Mail
20. ☐ Other items or information:

CERTIFICATE OF EXPRESS MAILING

I hereby certify that the attached documents were deposited with the United States Postal Service "Express Mail Post Office to Addressee" Express Mailing Label No. EL700369687US under 37 CFR 1.10 on November 2, 2000 and addressed to BOX PCT, Assistant Commissioner for Patents, Washington, D.C. 20231.

Jacqueline Walton

U.S. APPLICATION NO (IF KNOWN, SEE 37 CFR	INTERNATIONAL APPLICATION NO.	ATTORNEY'S DOCKET NUMBER
09/674585	PCT/US99/16412	60132-074

21. The following fees are submitted:.

BASIC NATIONAL FEE (37 CFR 1.492 (a) (1) - (5)) :

		CALCULATIONS PTO USE ONLY
☐	Neither international preliminary examination fee (37 CFR 1.482) nor international search fee (37 CFR 1.445(a)(2) paid to USPTO and International Search Report not prepared by the EPO or JPO	$1,000.00
☐	International preliminary examination fee (37 CFR 1.482) not paid to USPTO but Internation Search Report prepared by the EPO or JPO	$860.00
☐	International preliminary examination fee (37 CFR 1.482) not paid to USPTO but international search fee (37 CFR 1.445(a)(2)) paid to USPTO	$710.00
☒	International preliminary examination fee paid to USPTO (37 CFR 1.482) but all claims did not satisfy provisions of PCT Article 33(1)-(4)	$690.00
☐	International preliminary examination fee paid to USPTO (37 CFR 1.482) and all claims satisfied provisions of PCT Article 33(1)-(4)	$100.00

ENTER APPROPRIATE BASIC FEE AMOUNT =	$690.00	
Surcharge of **$130.00** for furnishing the oath or declaration later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (e))	$0.00	

CLAIMS	NUMBER FILED	NUMBER EXTRA	RATE		
Total claims	19 - 20 =	0	x $18.00	$0.00	
Independent claims	3 - 3 =	0	x $80.00	$0.00	
Multiple Dependent Claims **(check if applicable)**.			☐	$0.00	
TOTAL OF ABOVE CALCULATIONS			=	$690.00	
Reduction of 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed (Note 37 CFR 1.9, 1.27, 1.28) **(check if applicable)**.			☐	$0.00	
SUBTOTAL			=	$690.00	
Processing fee of **$130.00** for furnishing the English translation later than ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492 (f)).			+	$0.00	
TOTAL NATIONAL FEE			=	$690.00	
Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31) **(check if applicable).**			☐	$0.00	
TOTAL FEES ENCLOSED			=	$690.00	
				Amount to be: refunded	$
				charged	$

☒ A check in the amount of **$690.00** to cover the above fees is enclosed.

☐ Please charge my Deposit Account No. in the amount of to cover the above fees
A duplicate copy of this sheet is enclosed.

☒ The Commissioner is hereby authorized to charge any fees which may be required, or credit any overpayment to Deposit Account No. **08-2789** A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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NAME

22,981
REGISTRATION NUMBER

NOVEMBER 2, 2000
DATE

ELECTRO-OPTICAL MECHANICAL INSTRUMENT

BACKGROUND OF THE INVENTION

The present invention relates to optical scanners, and more particularly to a quasi con-focal microscope scanner in which the specimen and the scanner are simultaneously moved relative to each other.

Micro array biochips are currently being developed by several biotechnology companies. Micro array biochips are small substrates containing thousands of DNA sequences that represent the genetic codes of a variety of living organisms including human, plant, animal, and pathogens. They provide researchers with volumes of information in a more efficient format. Experiments can be conducted with significantly higher throughput than previous technologies offered. Biochip technology is used for genetic expression, DNA sequencing of genes, food and water testing for harmful pathogens, and diagnostic screening. Biochips may be used in pharmacogenomics and proteomics research aimed at high throughput screening for drug discovery. High-speed automated biochemistry may lead to drugs for treating illnesses including HIV, cancer, heart disease and others.

DNA sequences are extracted from a sample and are tagged with a fluorescent probe, a molecule that, when "excited" by a laser, will emit light of various colors. These fluorescently tagged DNA sequences are then spread over the chip. A DNA sequence will bind to its complementary (cDNA) sequence at a given array location. A typical biochip contains a two-dimensional array of thousands of cDNA sequences, each one unique to a specific gene. These cDNA sequences may be "printed" on the chip in several ways. Once the biochip is printed, it represents thousands of experiments in an area usually smaller than a postage stamp.

The chip is then ready to be scanned and analyzed with a scanning laser microscope using a dichromic beam splitter. However. The dichromic beam splitter has two drawbacks. Each time a specimen with a different dye is to be read, the beam splitter must be changed to match the different wavelengths

of operation of the new dye and the number of multiple dyes that can be simultaneously interrogated is usually limited to two.

The microscope collects data from successive "pixels" which are best dimensioned in microns. There are essentially two types of optical scanner, namely scanners that move scan heads and associated optics over stationary specimens, and scanners that move the specimens relative to stationary optics. Known scanning microscopes must therefore precisely align the optics of a moving scan head with the beam of a stationary laser, or alternatively carry the laser on the moving scan. A stationary laser can be aligned with a moving scan head only at relatively slow speeds, and therefore the scan speed of the system is inherently limited. The alternate system requires a relatively large scan head to carry the associated optics whereby the relatively great size and weight also effectively limits the scan speed.

SUMMARY OF THE INVENTION

The present invention provides a scanning laser microscope which can be used to scan biochips and display the information embodied in the fluorescent energy emitted by the individual dots as a pictorial representation of the array on a T.V. monitor. The means of interrogation is laser light (the excitation energy). The laser light excites the fluorescein that is contained in the fluorescent dyes. The fluorophores will subsequently emit light of a wavelength that is longer than the wavelength of the excitation energy. Thus, by using a beam splitting mirror, the number of different dyes that can be interrogated simultaneously is unlimited.

The optical diagram is a quasi con-focal microscope, *i.e.*, only an area the size of approximately one pixel is illuminated (excited) and observed (detected) at a time, however the size of the illuminating spot is not nearly as closely matched to that of the detected spot as it is in a pure con-focal microscope, in fact the former is about 10X larger in diameter than the latter.

The emitted light is conducted by lenses, mirrors, and optical filters to a detector, where it is converted into computer readable data.

The horizontal, or line scan (the X scan) is mechanized by moving the objective lens of the system rapidly back and forth in the X direction across the shorter length of a microscope slide specimen collecting data in each direction. The slide specimen does not move in the X direction as the vertical, or page scan (the Y scan) is mechanized by moving the slide specimen in the Y direction, incrementally advancing the slide each time the X scan is about to start a line.

The information is preferably processed so that it may be displayed in a convenient format such as tables, histograms and the like. The pictorial or image-processed information can thereafter be stored on a hard drive and sent to a hard copy printer, transmitted to a LAN, or transmitted over the Internet.

BRIEF DESCRIPTION OF THE DRAWINGS

Other advantages of the present invention will be readily appreciated as the same becomes better understood by reference to the following detailed description when considered in connection with the accompanying drawings wherein:

Figure 1 is a detailed perspective view of an optical instrument of the present invention;

Figure 2 is a plan view of a slide specimen of the present invention showing the movement of the scanning objective lens;

Figure 3 is a side view of the first drive mechanism; and

Figure 4 is a top view of the second drive mechanism.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT

An optical instrument 10 of the present invention is generally shown in Figure 1. As will be further described below the optical instrument 10

generally includes a transmitter 12 that emits an optical signal 14, a beam splitting mirror 20 having an opening 22, a reflector assembly 30 which directs the optical signal 14 onto a specimen 90, a detector assembly 40 which detects a reflected optical signal 44 from the specimen 90, a first drive mechanism 50 for varying the position of the optical signal 14 on the specimen 90, and a second drive mechanism 66 for varying the position of the specimen 90 relative to the optical signal 14.

Figure 1 illustrates the main components of the optical instrument 10 and the optical signal 14 path. The means of interrogation is preferably laser light and more than one laser can be incorporated into the system. Further, various types of lasers may be employed, such as argon-ion, semiconductor diode, and other similar solid state lasers. In the preferred embodiment, a plurality of lasers 12A-C, each operating on a different wavelength, are shown.

The optical signals 14A-C are each first transmitted through a beam correcting lens 16A-C and then through a continuously variable neutral density filter 18A-C, which is employed to adjust the intensity of the beam. The variable neutral density filter 18A-C can be an addressable array of several fixed neutral density filters of different densities, a pair of polarizers of which one is rotatable, or a rotating polarization retarder, in front of a polarizer.

To direct the optical signal 14, the reflector assembly 30 includes a plurality of turn mirrors 32A-C. Each optical signal 14A-C is folded as appropriate by the turn mirrors 32A-C to a beam combiner 34A-C. The beam combiner is preferably a know dichroic filter which transmits light of one wavelength while blocking others. The individual optical signal are thereby collected into a combined beam along a first path which then passes through the opening 22 in the beam splitting mirror 20. The combined beam is then directed to a 90 degree fold mirror 36 located immediately above the scanning

objective lens 52. The fold mirror 36 reflects the combined optical signal 14 into the scanning objective lens 52, which in turn is focused onto the specimen 90, thus creating a scanning illumination spot. The embodiment shown in Figure 1 shows three laser transmitters 12A-C, however, those skilled in the art will realize that additional lasers can be used to interrogate multiple dyes of different fluorescent properties in the specimen 90 simultaneously or sequentially. The optical signal from each additional laser is located downstream from the last laser and is brought onto the system optical axis *via* reflection off a dichromic beam combiner.

When illuminated by the combined beam the fluorophores will emit energy all around, *i.e.*, into 4 pi directions. It is imperative to collect as much of this energy as possible, so it is preferable to employ a custom designed objective lens 52 such as one, for example only, with an NA=0.9, air-coupled 4. The objective lens 52 preferably outputs a beam of emitted energy concentric with the laser beam, having a diameter about 10X larger than that of the laser beam.

After reflecting from the specimen the fold mirror 36 located above the scanning lens 52 will fold the reflected optical signal 44 along a second path. The reflected optical signal 44 is again directed by 90 degrees towards the beam splitting mirror 20. The latter will fold the emission beam 90 degrees away from the combined optical signal first path, except for a very small central portion in the middle as determined by the opening 22 in the beam splitting mirror 20. It can be seen that a for a portion of the path the original combined optical signal 14 traveling along the first path, and the reflected optical signal 44 traveling along the second path, have a common path segment. This common path segment is shown between the beam splitting mirror 20 the fold mirror 36, and the scanning lens 52.

The reflected optical signal 44 reflecting from the opposite side of the beam splitting mirror 20 will then pass through a plurality of beam splitters

38A-B to separate the combined signal into individual signals 44A-C. Each individual signal 44A-C passes through an emission filter 46A-C, and will then be focused by a detector lens 48A-C into a pinhole. The pinhole acts as the field stop of the system, *i.e.*, it defines the size of the scanning detection aperture on the slide. Finally, the individual signals 46A-C diverts once through the pinhole until it impinges onto a detector 42A-C.

As shown in Figure 2 the horizontal, or line scan (the X scan) is mechanized by moving the objective lens 52 of the system rapidly (20 Hz or so) back and forth in the X direction across the shorter length of a microscope slide specimen 90 (commonly 1 inch wide), collecting data in each direction. Note that the slide specimen 90 does not move in the X direction. The vertical or page scan (the Y scan), is mechanized by moving the slide specimen 90 in the Y direction, incrementally advancing the slide specimen 90 each time the X scan is about to start a line scan as further described below.

Figure 3 shows the first drive mechanism 50 for varying the position of the combined optical signal on the specimen 90. The first or X scan mechanism preferably employs a galvanometric torque motor 54 to rotate a sector-shaped cam 56 over an angle between+40 degrees, and -40 degrees. The circular portion of the cam 56 is connected to the carriage 58 *via* a set of roll-up, roll-off thin, high-strength steel wires 66A-B. The scanning objective lens 52 is attached to the carriage 54. The radius of the cam 56 is such that its degree rotation will cause the carriage 58 to travel a linear distance along a rail 60 commensurate with the length of the X scan pattern of the objective lens 52.

Figure 4 shows the second drive mechanism 70. The second or Y scan mechanism employs a stepper motor 72 to drive a precision screw 74 in a known manner. The nut 76 on the screw 74 is attached to the carriage 58, so that any rotation of the screw 74 will cause the carriage 58 to move along a linear rail 60. The carriage 58 in turn is equipped with a tray 76. The tray

76 is equipped with appropriate retainers 78 to hold a specimen slide 90 in a position and orientation which is repeatable within an accuracy required by optical focus and alignment criteria. The rail of the linear slide and the stepper motor 72 are attached to the frame of the Y scan mechanism.

In an alternate embodiment, the carriage 58 is pivotally mounted such that the carriage 58, and thus the objective lens 52, move in an arcuate motion. The arcuate motion is thereafter converted into linear motion by know computer mapping programs.

The frame of the Y scan mechanism is further attached to the carriage of a vertically oriented linear slide. The rail of the slide is mounted to the main frame of the reader system. The carriage is supported by a precision screw, the nut of which is attached to the frame. The screw is turned causing the Y scan mechanism, and with it the slide holding the specimen, to move toward or away from the objective lens, thus affecting a focusing sequence.

The foregoing description is exemplary rather than limiting in nature. Obviously, many modifications and variations of the present invention are possible in light of the above teachings. It is, therefore, to be understood that within the scope of the appended claims the invention may be practiced otherwise than as specifically described.

CLAIMS

What is claimed is:

1. An optical instrument comprising:

a transmitter that emits an optical signal;

a reflector assembly which directs said optical signal onto a specimen;

a detector assembly which detects a reflected optical signal from the specimen;

a first drive mechanism for varying the position of said optical signal on the specimen; and

a second drive mechanism for varying the position of the specimen relative to said optical signal.

2. The optical instrument of claim 1, wherein said reflector assembly directs said optical signal along a first path onto the specimen and directs said reflected optical signal along a second path to said detector, said first path and said second path having a common path segment.

3. The optical instrument of claim 2, further comprising a beam splitting mirror having an opening, said beam splitting mirror defining one end of said common path segment.

4. The optical instrument of claim 3, wherein said first path and said second path approach said beam splitting mirror from a first direction and a second direction respectively.

5. The optical instrument of claim 4, wherein said beam splitting mirror allows passage of said first path through said opening and reflects said second path.

6. The optical instrument of claim 1, wherein said second drive mechanism moves the specimen in a linear manner.

7. The optical instrument of claim 1, wherein said second drive mechanism moves the specimen in an arcuate manner.

8. The optical instrument of claim 1, wherein said first drive mechanism moves said optical signal substantially perpendicular to movement of the specimen.

9. The optical instrument of claim 1, wherein said first drive mechanism includes a scanning lens to focus said optical signal onto the specimen.

10. The optical instrument of claim 1, wherein said first drive mechanism includes a galvanometric torque motor.

11. An optical instrument comprising:

a transmitter that emits an optical signal;

a beam splitting mirror having an opening;

a reflector assembly which directs said optical signal along a first path passing through said opening and onto a specimen;

a detector assembly which detects a reflected optical signal from the specimen, said reflected optical signal defining a second path directed by said beam splitting mirror;

a first drive mechanism including a scanning lens for varying the position of said optical signal on the specimen; and

a second drive mechanism for varying the position of the specimen relative to said optical signal.

12. The optical instrument of claim 11, wherein said transmitter includes a plurality of lasers having optical signal of different wavelengths.

13. The optical instrument of claim 12, further comprising a dichroic beam combiner to combine said plurality of optical signals along said first path.

14. The optical instrument of claim 11, wherein said first drive mechanism includes:

a galvanometric torque motor having a sector shaped cam;

a carriage;

a retainer to fixedly hold a specimen to said carriage; and

a first and second wire attached between said cam and said carriage, whereby rotation of said cam is translated into linear movement of the specimen.

15. The optical instrument of claim 11, wherein said secondt drive mechanism includes:

a precision stepper motor having a screw;

a carriage having a nut engaging said screw;

a retainer to fixedly hold a specimen to said carriage; and

said stepper motor operable to rotate said screw, whereby rotation of said screw is translated into linear movement of the specimen.

16. A method of scanning fluorescent samples comprising the steps of:

(a) exciting the samples with an optical signal of a known first wavelength;

(b) detecting an optical signal of a second wavelength;

(c) translating said optical signal in a first and second direction; and

(d) translating the sample in a third direction substantially perpendicular to said first and said second direction.

17. A method as recited in claim 16, wherein step (a) further comprises combining a plurality of optical signals prior to exciting of the sample.

18. A method as recited in claim 16, wherein step (b) further comprises splitting said optical signal into a plurality of optical signals prior to detecting.

19. A method as recited in claim 16, wherein a portion of said exciting optical signal and a portion of said detecting optical signal have a common path.

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International Bureau

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(72) Inventors; and

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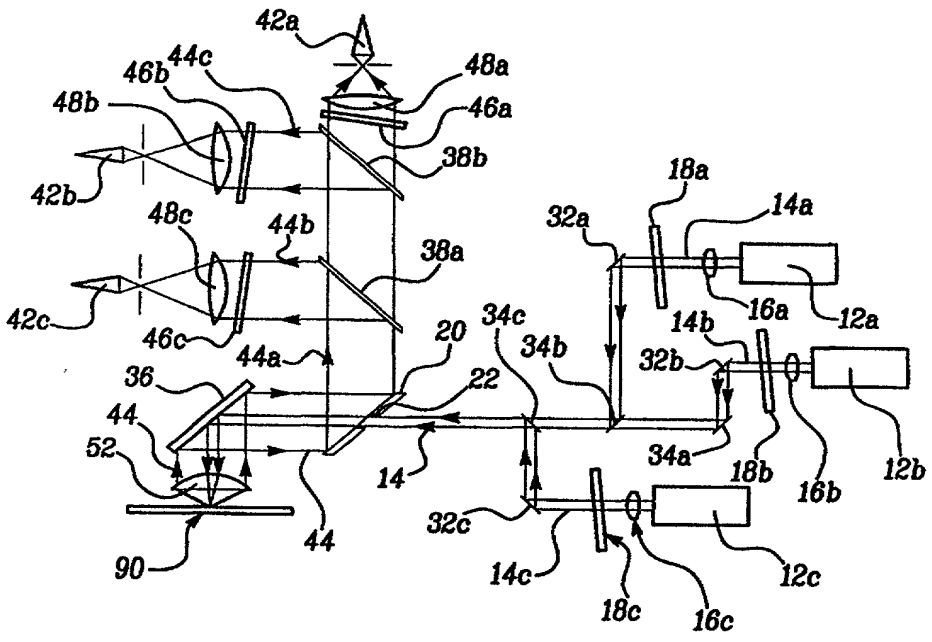
Published
With international search report.

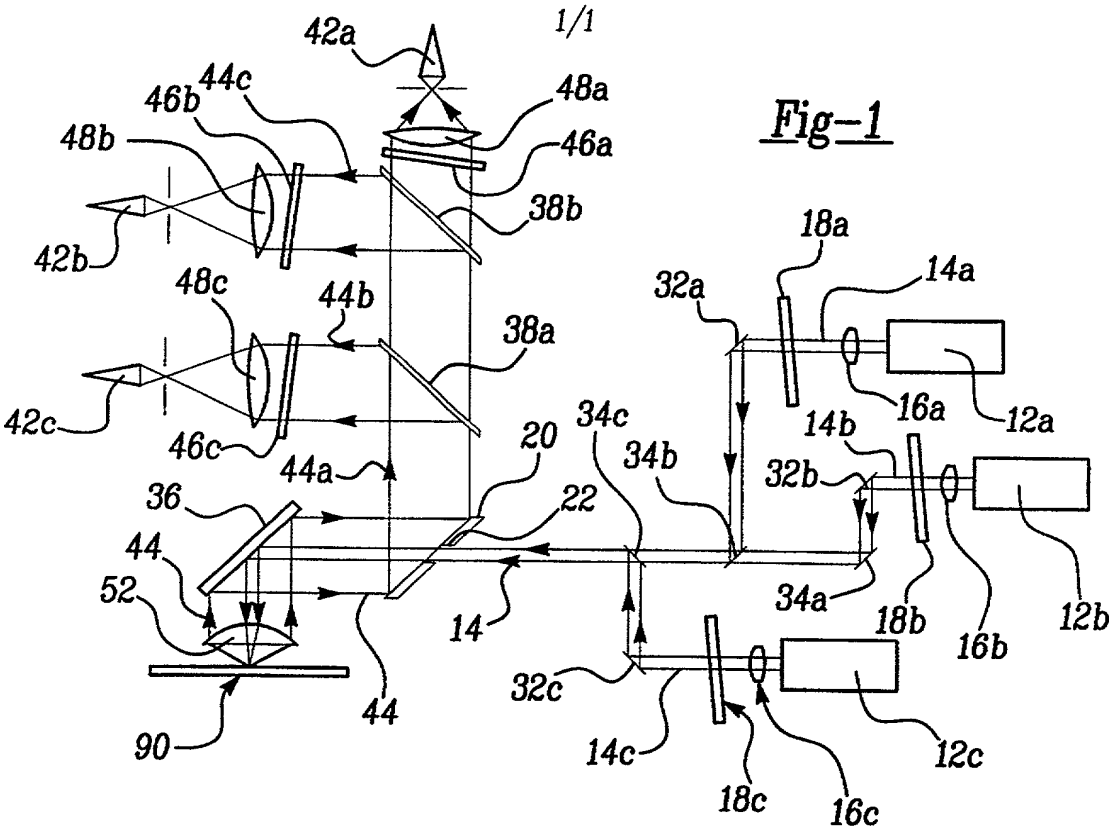
(54) Title: ELECTRO–OPTICAL MECHANICAL INSTRUMENT



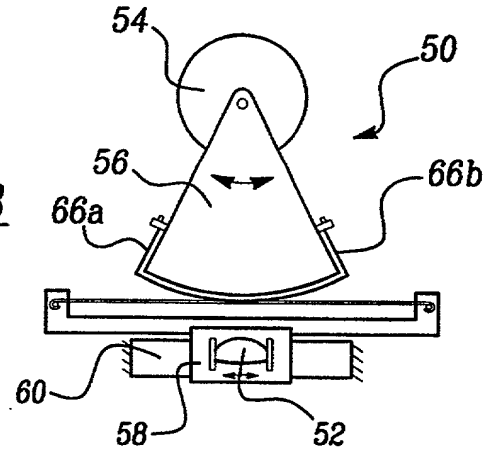
(57) Abstract

A scanning laser microscope which can be used to scan biochips includes a transmitter, comprising lasers (12A–C), that emits an optical signal (14), a beam slitting mirror (20) having an opening (22), a reflector (36) which directs the optical signal (14) onto a specimen (90), a detector assembly, including detectors (42A–C), which detects a reflected optical signal (44) from the specimen (90), a first drive mechanism for varying the position of the optical signal (14) on the specimen (90) and a second drive mechanism for varying the position of the specimen (90) relative to the optical signal (14).

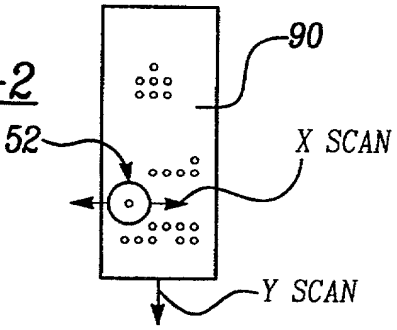
1/1



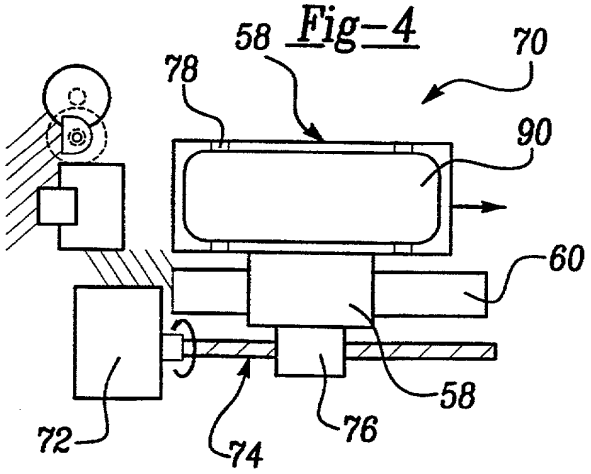
Fig–1



Fig–3



Fig–2



Fig–4

COMBINED DECLARATION AND POWER OF ATTORNEY

As the below named inventors, we hereby declare: that our residences, post office addresses and citizenships are as stated near our names below; that we are joint inventors and we believe we are the original and first inventors of the subject matter of which is claimed and for which a patent is sought on the invention entitled

ELECTRO-OPTICAL MECHANICAL INSTRUMENT

which is described and claimed in the specification of which was filed on July 23, 1998 as United States Provisional Application Serial No. 60/093,882; attorney docket number 60,132-062 and that this application was filed on November 2, 2000 as International Application (PCT) No. PCT/US99/16412.

We have reviewed and understand the contents of this specification, including the claims, as amended by any amendment referred to above; that we do not know and do not believe the same was ever known or used in the United States of America before our invention thereof or patented or described in any printed publication, in any country before our invention thereof for more than one year prior to this application, or in public use or on sale in the United States of America more than one year prior to this application; that the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by us or our legal representatives or assigns more than twelve (12) months prior to this application; that we acknowledge our duty to disclose information of which we are aware which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56(a); and that no application for patent or inventor's certificate on this invention has been filed in any country foreign to the United States of America prior to this application by us or our legal representatives or assigns except as follows:

PRIORITY CLAIM

We hereby claim the benefit under 35 U.S.C. Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. Section 112. I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, C.F.R., Section 1.58 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

APPLICATION NUMBER	DATE OF FILING (month, day, year)	STATUS
PCT/US99/16412	November 2, 2000	Pending

We hereby claim foreign priority benefits under Title 35, United States Code, §119(a)-(d) of the foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application(s) for patent or inventor's certificate filed on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

Such applications have been filed as follows:

COUNTRY	APPLICATION NUMBER	DATE OF FILING (month, day, year)	PRIORITY CLAIMED UNDER 37 USC 119
USA	60/093,882	July 23, 1998	Yes_X_ No____

We hereby appoint Raymond E. Scott, Registration No. 22,981; Randall L. Shoemaker, Registration No. 43,118; Samuel J. Haidle, Registration No. 42,619; William H. Honaker, Registration No. 31,623; Harold W. Milton, Jr., Registration No. 22,180; Jeffrey A. Sadowski, Registration No. 29,005; Kevin MacKenzie, Registration No. 45,639; David M. LaPrairie, Registration No. 46,295; Bharat C. Gandhi, Registration No. 35,146; Steven C. Wichmann, Registration No. 37,758; and James R. Yee, Registration No. 34,460 as our attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith. Please address all correspondence and telephone calls to:

RAYMOND E. SCOTT
HOWARD & HOWARD ATTORNEYS, P.C.
The Pinehurst Office Center
39400 Woodward Avenue, Suite 101
Bloomfield Hills, MI 48304-5151
(248) 645-1483

We hereby declare that all statements made herein of our own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Herman DeWeerd

Post Office Address:
8 Cresent Avenue
Bedford, MA 01730
Citizenship: MA

Dated: 4/10-01

Michael Beach

Post Office Address:
204 Auburn Street
Cambridge, MA 02139
Citizenship:

Dated:_____

Jose Hernandez

Post Office Address:
81 Cross Street
Somerville, MA 02145
Citizenship:

Dated:_____

COMBINED DECLARATION AND POWER OF ATTORNEY

As the below named inventors, we hereby declare: that our residences, post office addresses and citizenships are as stated near our names below; that we are joint inventors and we believe we are the original and first inventors of the subject matter of which is claimed and for which a patent is sought on the invention entitled

ELECTRO-OPTICAL MECHANICAL INSTRUMENT

which is described and claimed in the specification of which was filed on July 23, 1998 as United States Provisional Application Serial No. 60/093,882; attorney docket number 60,132-062 and that this application was filed on November 2, 2000 as International Application (PCT) No. PCT/US99/16412.

We have reviewed and understand the contents of this specification, including the claims, as amended by any amendment referred to above; that we do not know and do not believe the same was ever known or used in the United States of America before our invention thereof or patented or described in any printed publication, in any country before our invention thereof for more than one year prior to this application, or in public use or on sale in the United States of America more than one year prior to this application; that the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by us or our legal representatives or assigns more than twelve (12) months prior to this application; that we acknowledge our duty to disclose information of which we are aware which is material to the examination of this application in accordance with Title 37, Code of Federal Regulations, Section 1.56(a); and that no application for patent or inventor's certificate on this invention has been filed in any country foreign to the United States of America prior to this application by us or our legal representatives or assigns except as follows:

PRIORITY CLAIM

We hereby claim the benefit under 35 U.S.C. Section 120 of any United States application(s), or Section 365(c) of any PCT International application designating the United States, listed below and insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of 35 U.S.C. Section 112. I acknowledge the duty to disclose to the United States Patent and Trademark Office all information known to me to be material to patentability as defined in Title 37, C.F.R., Section 1.58 which became available between the filing date of the prior application and the national or PCT International filing date of this application:

APPLICATION NUMBER	DATE OF FILING (month, day, year)	STATUS
PCT/US99/16412	November 2, 2000	Pending

We hereby claim foreign priority benefits under Title 35, United States Code, §119(a)-(d) of the foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application(s) for patent or inventor's certificate filed on the same subject matter having a filing date before that of the application(s) of which priority is claimed.

Such applications have been filed as follows:

COUNTRY	APPLICATION NUMBER	DATE OF FILING (month, day, year)	PRIORITY CLAIMED UNDER 37 USC 119
USA	60/093,882	July 23, 1998	Yes_X_ No____

We hereby appoint Raymond E. Scott, Registration No. 22,981; Randall L. Shoemaker, Registration No. 43,118; Samuel J. Haidle, Registration No. 42,619; William H. Honaker, Registration No. 31,623; Harold W. Milton, Jr., Registration No. 22,180; Jeffrey A. Sadowski, Registration No. 29,005; Kevin MacKenzie, Registration No. 45,639; David M. LaPrairie, Registration No. 46,295; Bharat C. Gandhi, Registration No. 35,146; Steven C. Wichmann, Registration No. 37,758; and James R. Yee, Registration No. 34,460 as our attorneys to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith. Please address all correspondence and telephone calls to:

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Name:	**Herman DeWeerd**	**Dated**
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2-00

M. Thael E Beach
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COMBINED DECLARATION AND POWER OF ATTORNEY

As the below named inventors, we hereby declare: that our residences, post office addresses and citizenships are as stated near our names below; that we are joint inventors and we believe we are the original and first inventors of the subject matter of which is claimed and for which a patent is sought on the invention entitled

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PRIORITY CLAIM

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We hereby declare that all statements made herein of our own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

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10057565.021502

Docket No 60132-074

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